N67 80038

National Aeronautics and Space Administration

SC-NGR-22-009-125

Semi-annual Progress Report

October 1966

Professor Harry C. Gatos
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Semi-annual Progress Report

SC-NGR-22-009-125

October 1966

The superconductivity studies on the transition metal alloy phases at the AB composition have now been extended to Nb-Pd-Ru, Nb-Ru-Pt, Nb-Ir-Pt, Zr-Rh-Pt, Mo-Pd-Pt, Mo-Pd-Ru, Mo-Ir-Pt and Mo-Ru-Pt pseudobinary systems. Typical examples of new superconductors are given below with their transition temperatures (°K) in parenthesis: NbPd (1.53), $NbRu_{0.7}Pt_{0.3}$ (3.5), $NbRu_{0.5}Pt_{0.5}$ (3.13), $Nb_{0.45}Ru_{0.275}Pt_{0.275}$ (2.44), $NbPt_{0.95}Ir_{0.05}$ (1.3), $NbPt_{0.9}Ir_{0.1}$ (1.98), MoPd (3.85), $MoPd_{0.5}Pt_{0.5}$ (1.85) and $MoRu_{0.5}Pt_{0.5}$ (2.77). The following compositions are normal down to 1.4°K: $NbPd_{0.75}Ru_{0.25}$, $NbPd_{0.25}Ru_{0.75}$, ZrRh, $ZrRh_{0.5}Pt_{0.5}$, $MoIr_{0.25}Pt_{0.75}$, $MoIr_{0.75}Pt_{0.25}$ and $MoRu_{0.25}Pt_{0.75}$. The addition of a third platinum group metal to a binary alloy is thus seen either to weaken (Pt to MoRu) or strengthen (Ir to NbPt) the superconducting interactions. Magnetic susceptibility and electronic specific heat measurements on selected alloy phases are being planned.

The work on superconductivity among platinum and gold rich alloys have been extended from the transition metal to rare earth alloys. The AB_3 phases in the Y-Au, Ho-Au, Dy-Au, Gd-Au, Er-Au and Yb-Au systems have been synthesized. Their crystal structure has been established as the ordered, orthorhombic $TiCu_3$ type. The superconducting behavior of these gold rich phases are being examined.

The studies on the superconductivity of the transition metal carbides have been pursued further. A variety of new carbides with the β-Mn structure (Mo_3Re_2C, W_3Re_2C and Ta_3Al_2C), Mo_2C structure (Mo_2C-Re, Mo_2C-Cr solid solutions), $D8_8$ structure (Mo_5Ge_3C) and B1 structure ($MoC_{0.97}B_{0.03}$) have been prepared and their transition temperatures are being determined.

A large number of the body centered cubic solid solution compositions in the Nb-Ti-V and Nb-Ti-Mo systems have been prepared. Preliminary work has been initiated to study the nature of the structural damage caused by internal fission in the alloys of Nb-Ti-V system and to relate it to the changes in the superconducting properties. The internal fission is to be achieved by doping the alloys with enriched uranium and subsequently irradiating them with thermal neutrons.

Preliminary work has also been initiated to study the nature of the radiation induced disorder in the σ-phases of the Nb-Al, and Mo-Re systems and its effect on the superconducting transition temperature. Internal fission and fast neutrons are used to create disorder in the lattice of the σ-phase.

An apparatus has been designed and built for superconducting transition measurements in the range of 0.8 - 4.2°K.